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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/935,493	08/23/2001	Richard E. Smalley	11321-P034US	1436

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5400 Renaissance Tower  
Dallas, TX 75270-2199

EXAMINER
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TSOY, ELENA

ART UNIT	PAPER NUMBER
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1762

DATE MAILED: 06/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	09/935,493	SMALLEY ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Elena Tsoy	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10/18/2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 11-15, 17-27, 47-76, 78, 79, 81, 82, 84 and 85 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-15, 17-27, 47-76, 78, 79, 81, 82, 84 and 85 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____                                    |

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***Response to Amendment***

1. Amendment filed on May 9, 2005 has been entered. Claims 77, 80, 83, and 86 have been cancelled. Claims 11-15, 17-27, 47-76, 78, 79, 81-82, 84-85 are pending in the application.

***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
- (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 11, 15, 47, 78, 79** are rejected under 35 U.S.C. 103(a) as being unpatentable over Shaffer et al (Advanced materials, 11, No. 11, 1999) in view of Panek et al (US 4,143,026) and Colman et al (US 6,384,297).

Shaffer et al disclose a method for making polymer-coated carbon nanotubes comprising mixing aqueous solution of PVOH polymer with catalytically grown carbon nanotubes (See page 937, paragraph 2) followed by casting and controlled water evaporation (See page 938, paragraph

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2) so that to cover the nanotube with an adsorbed layer of the polymer (See page 938, paragraph 3). The Examiner's Note: it is well known in the art that any existing techniques contain both MWNTs and SWNTs.

Shaffer et al fail to teach that polymer-coated carbon nanotubes can be obtained by adding salt to a mixture of the carbon nanotubes and the polymer in a quantity effective to promote coating of the polymer on nanotubes (Claim 11); the salt is NaCl (Claims 78, 79).

Panek et al teach that polymer-coated solid inorganic particles can be obtained by adding salts or other electrolytes to a mixture of the particles and polymers dissolved or suspended in water or in organic solvents to deposit polymers on the particles by altering the solubility of polymers thereby obtaining polymer coated particles (See column 1, lines 44-57).

Colman et al teach that it is well known that addition of an inorganic salt such as NaCl, KCl, NaBr (See column 5, lines 54-55) to an aqueous solution of a water-soluble polymer may force polymer precipitation through a salting-out phenomenon. For example, anionic polymers such as sodium salts of polyacrylate and carboxymethyl cellulose become insoluble in an aqueous solution of common salt having a concentration of 4 to 5% or higher; non-ionic polymers such as hydroxyethyl cellulose and polyvinyl alcohol (PVA) are insoluble in an aqueous solution only when the concentration of the salt is increased to about 10% or higher (See column 5, lines 56-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added salt to a mixture comprising nanotubes and polymers dissolved in water or in organic solvents in a method of Shaffer et al in an effective quantity with the expectation of promoting coating of the polymer on the nanotubes, as taught by Panek et al and Colman et al.

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5. **Claims 11-15, 17-19, 24, 48, 78, 79** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davey et al (US 6,576,341) in view of Dillon et al (US 20020150529), further in view of Panek et al and Colman et al.

Davey et al in view of Dillon et al are applied for the reasons of record as set forth in Paragraph No. 13 of the Office Action mailed on 11/17/2004. Davey et al in view of Dillon et al fail to teach that polymer-coated carbon nanotubes can be obtained by adding salt to a mixture of the carbon nanotubes and the polymer in a quantity effective to promote coating of the polymer on nanotubes (Claim 11); the salt is NaCl (Claims 78, 79).

Panek et al and Colman et al are applied for the same reasons as above.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added salt to a mixture comprising nanotubes and polymers dissolved in water or in organic solvents in a method of Davey et al in view of Dillon et al in an effective quantity with the expectation of promoting coating of the polymer on the nanotubes, as taught by Panek et al and Colman et al.

6. **Claim 17** is rejected under 35 U.S.C. 103(a) as being unpatentable over Shaffer et al in view of Panek et al and Colman et al, further in view of Uchida et al (US 5,560,898).

Shaffer et al in view of Panek et al and Colman et al are applied for the same reasons as above. Shaffer et al in view of Panek et al and Colman et al fail to teach that the solvent further comprises a surfactant.

Uchida et al that adding a polymeric surfactant such as sodium oleate, polyoxyethylene alkylphenyl ether or polyoxyethylenepolyol carboxylic acid ester to a suspension of carbon nanotubes in water accelerates the dispersion of carbon nanotubes (SWNT and MWNT) (See column 2, lines 25-29).

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added a polymeric surfactant to a mixture of Shaffer et al before adding salt with the expectation of providing the desired accelerated dispersion of carbon nanotubes in the mixture, as taught by Uchida et al, so that to evenly coat nanotubes with polymers.

7. **Claims 20-23, 49-54, 56-58, 60-64, 67-69, 71-73, 81, 82, 84, 85** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davey et al in view of Dillon et al, further in view of Tohji et al (Fullerene Science and Technology, 7(4), 665-679, 1999), and further in view of Panek et al and Colman et al.

Davey et al in view of Dillon et al in view of Tohji et al are applied for the reasons of record as set forth in Paragraph No. 14 of the Office Action mailed on 11/17/2004. Davey et al in view of Dillon et al in view of Tohji et al fail to teach that polymer-coated carbon nanotubes can be obtained by adding salt to a mixture of the carbon nanotubes and the polymer in a quantity effective to promote coating of the polymer on nanotubes (Claim 20); the salt is NaCl (Claims 81, 82, 84, 85).

Panek et al and Colman et al are applied for the same reasons as above.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added salt to a mixture comprising nanotubes and polymers dissolved in water or in organic solvents in a method of Davey et al in view of Dillon et al in view of Tohji et al in an effective quantity with the expectation of promoting coating of the polymer on the nanotubes, as taught by Panek et al and Colman et al.

8. **Claims 20-23, 49-54, 66, 75, 81, 82, 84, 85** are rejected under 35 U.S.C. 103(a) as being unpatentable over Shaffer et al in view of Tohji et al (Fullerene Science and Technology, 7(4), 665-679, 1999), further in view of Panek et al and Colman et al.

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Shaffer et al in view of Tohji et al are applied for the reasons of record as set forth in Paragraph No. 11 of the Office Action mailed on April 20, 2004. Shaffer et al in view of Tohji et al fail to teach that polymer-coated carbon nanotubes can be obtained by adding salt to a mixture of the carbon nanotubes and the polymer in a quantity effective to promote coating of the polymer on nanotubes (Claim 20); the salt is NaCl (Claims 81, 82, 84, 85).

Panek et al and Colman et al are applied for the same reasons as above.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added salt to a mixture comprising nanotubes and polymers dissolved in water or in organic solvents in a method of Shaffer et al in view of Tohji et al in an effective quantity with the expectation of promoting coating of the polymer on the nanotubes, as taught by Panek et al and Colman et al.

9. **Claims 25, 26, 76** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davey et al (US 6,576,341) in view of Dillon et al (US 20020150529), further in view of Mueller (US 4,098,742).

Davey et al in view of Dillon et al are applied here for the reasons of record as set forth in Paragraph No. 13 of the Office Action mailed on 11/17/2004. Davey et al disclose a process for purification of nanotube (including SWNT and MWNT) soot in a non-destructive and efficient method using a polymer having a coiling structure to extract nanotubes from their accompanying material without damage to their structure and with a high mass yield. Nanotube soot is added to a solvent which including a coiling polymer to form a solution. The solution is mixed with a nanotube composite suspension is formed with extraneous solid material such as amorphous carbon settling at the bottom of the solution. The nanotube composite suspension is decanted from

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the settled solid. See Abstract. Obviously, the coating of the coiling polymer should be removed to obtain purified nanotubes.

Davey et al in view of Dillon et al fail to teach that the removal of polymer coat comprises contacting the coated nanotubes with a second solvent having a low surface tension (Claim 25) such as chlorinated hydrocarbon (Claim 26) or tetrahydrofuran (Claim 76).

Mueller teaches that a solvent will not wet a coating with a surface tension lower than that of the solvent (See column 1, lines 37-41).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have removed a polymer coating in Davey et al in view of Dillon et al using a second solvent having surface tension lower than that of a first solvent in which a polymer was dissolved, with the expectation of providing the desired wetting, as taught by Mueller.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected the second solvent among conventional solvents such as chlorinated hydrocarbons and tetrahydrofuran depending on the first solvent, with the expectation of providing the desired wetting.

10. **Claim 27** is rejected under 35 U.S.C. 103(a) as being unpatentable over Shaffer et al in view of Panek et al and Colman et al/Davey et al in view of Dillon et al in view of Panek et al and Colman et al, further in view of Bower et al (EP 989579).

Shaffer et al in view of Panek et al and Colman et al/Davey et al in view of Dillon et al in view of Panek et al and Colman et al are applied for the same reasons as above. Shaffer et al in view of Panek et al and Colman et al/Davey et al in view of Dillon et al in view of Panek et al and Colman et al fail to teach that the method further comprises the step of aligning the nanotubes by



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application of an external field selected from the group consisting of an electrical field, a magnetic field and a shear flow field.

Bower et al teach that a mixture of purified SWNT or MWNT (See [0018], [0020], column 13, line 25) with solvents and polymers to form a solution or slurry (See [0028], [0029]), applied to a substrate can be aligned by application of an external field selected from the group consisting of an electrical field, a magnetic field and a shear flow field (See claim 15; column 9, lines 38-40; column 10, lines 18-43, 56).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have aligned polymer-coated nanotubes in Shaffer et al in view of Panek et al and Colman et al/Davey et al in view of Dillon et al in view of Panek et al and Colman et al by application of an external field selected from the group consisting of an electrical field, a magnetic field and a shear flow field since Bower et al teach that a mixture of SWNT or MWNT and polymers can be aligned by application of an external field selected from the group consisting of an electrical field, a magnetic field and a shear flow field.

11. **Claim 47** is rejected under 35 U.S.C. 103(a) as being unpatentable over Davey et al in view of Dillon et al in view of Panek et al and Colman et al, further in view of Shaffer et al (Advanced materials, 11, No. 11, 1999).

Davey et al in view of Dillon et al in view of Panek et al and Colman et al as applied above, further teach that any polymer preferably of coiling structure can be used for wrapping carbon nanotubes (See column 3, lines 1-7). However, Davey et al/in view of Dillon et al in view of Panek et al and Colman et al fail to teach that the polymer is polyvinyl alcohol.

Shaffer et al teach that polyvinyl alcohol can be used for covering carbon nanotubes in water by mixing (See page 938, P3).

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used polyvinyl alcohol as a polymer in Davey et al in view of Dillon et al in view of Panek et al and Colman et al since Shaffer et al disclose polyvinyl alcohol is suitable for covering carbon nanotubes in water by mixing.

It is held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960) (selection of a known plastic to make a container of a type made of plastics prior to the invention was held to be obvious); *Ryco, Inc. v. Ag-Bag Corp.*, 857 F.2d 1418, 8 USPQ2d 1323 (Fed. Cir. 1988).

12. **Claim 55** is rejected under 35 U.S.C. 103(a) as being unpatentable over Davey et al in view of Dillon et al in view of Panek et al and Colman et al, further in view of Hsu et al (US 6,333,598).

Davey et al in view of Dillon et al in view of Panek et al and Colman et al are applied here for the same reasons as above. Davey et al in view of Dillon et al in view of Panek et al and Colman et al fail to teach that the solvent further comprises a surfactant such as sodium dodecyl sulfate.

Hsu et al teach that carbon nanotubes can be treated with a micellar surfactant such as sodium dodecylsulfate (SDS), which attach to the nanotube in a shell, to provide negatively-charged end groups that project outward to the water phase, which end groups will preferentially attach to a hydrophobic (e.g., octadecanethiol-coated noble metal) surface but would not attach to negatively charged surfaces (See column 15, lines 5-19).

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added sodium dodecylsulfate to the solvent in a method of Davey et al in view of Dillon et al in view of Panek et al and Colman et al with the expectation of providing the desired attachment to hydrophobic (e.g., octadecanethiol-coated noble metal) surface, and not to negatively charged surfaces depending on particular application, as taught by Hsu et al.

13. **Claims 59, 70** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davey et al in view of Dillon et al, further in view of Tohji et al, further in view of Panek et al and Colman et al, and further in view of Hsu et al (US 6,333,598).

Davey et al in view of Dillon et al in view of Tohji et al in view of Panek et al and Colman et al are applied here for the same reasons as above. Davey et al in view of Dillon et al in view of Tohji et al in view of Panek et al and Colman et al fail to teach that the surfactant is sodium dodecyl sulfate.

Hsu et al are applied here for the same reasons as above.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added sodium dodecylsulfate to the solvent in a method of Davey et al in view of Dillon et al in view of Tohji et al in view of Panek et al and Colman et al with the expectation of providing the desired attachment to hydrophobic (e.g., octadecanethiol-coated noble metal) surface, and not to negatively charged surfaces depending on particular application, as taught by Hsu et al.

14. **Claims 65, 74** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davey et al in view of Dillon et al, further in view of Tohji et al, further in view of Panek et al and Colman et al, and further in view of Bower et al (EP 989579).

Davey et al in view of Dillon et al in view of Tohji et al in view of Panek et al and Colman et al are applied here for the same reasons as above. Davey et al in view of Dillon et al in view of

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Tohji et al in view of Panek et al and Colman et al fail to teach that the method further comprises the step of aligning the nanotubes by application of an external field selected from the group consisting of an electrical field, a magnetic field and a shear flow field.

Bower et al are applied here for the same reasons as above.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have aligned polymer-coated nanotubes in Davey et al in view of Dillon et al in view of Tohji et al in view of Panek et al and Colman et al are applied here for the same reasons as above. Davey et al in view of Dillon et al in view of Tohji et al in view of Panek et al and Colman et al by application of an external magnetic and/or electric fields with the expectation of providing the desired reduced overall energy of the system since Bower et al teach that a mixture of SWNT and/or MWNT and polymers applied to a substrate can be aligned by application magnetic and/or electric fields in order to reduce the overall energy of the system.

15. **Claims 66, 75** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davey et al in view of Dillon et al, further in view of Tohji et al, further in view of Panek et al and Colman et al, further in view of Shaffer et al.

Davey et al in view of Dillon et al in view of Tohji et al in view of Panek et al and Colman et al are applied here for the same reasons as above. Davey et al in view of Dillon et al in view of Tohji et al in view of Panek et al and Colman et al fail to teach that the polymer is polyvinyl alcohol.

Shaffer et al teach that polyvinyl alcohol can be used for covering carbon nanotubes in water by mixing (See page 938, P3).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used polyvinyl alcohol as a polymer in Davey et al in view of Dillon et al in view of

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Tohji et al in view of Panek et al and Colman et al in view of Tohji et al since Shaffer et al disclose polyvinyl alcohol is suitable for covering carbon nanotubes in water by mixing.

16. The prior art made of record and not relied upon is considered pertinent to applicant disclosure.

Dickson et al (US 3,993,830) teach that adding polyvalent metal salt such as alkaline earth metal salt to a dilute aqueous solution of a polycarboxylate polymer serves to decrease the solubility of the polymer sufficiently to cause the polymer to be deposited onto the fabric from the dilute aqueous solution (See column 3, lines 6-14).

#### ***Response to Arguments***

17. Applicants' arguments filed May 9, 2005 have been fully considered but they are not persuasive.

Applicants state that Dillon is not a valid prior art reference; thus, these rejections are improper and must be withdrawn. The present Application has a date of priority of August 24, 2000 (U.S. Provisional Patent Application Serial No. 60/227,604). Dillon bases its priority upon PCT Patent application PCT/USO1/01698, which was filed January 17, 2001. Thus, the earliest priority date of Dillon is January 17, 2001, which is after the effective filing date of the present Application.

The Examiner respectfully disagrees with this statement. The 35 U.S.C. 102(e) critical reference date of a U.S. patent or U.S. application publications and certain international application publications entitled to the benefit of the filing date of a provisional application under 35 U.S.C. 119(e) is the filing date of the provisional application with certain exceptions if the provisional application(s) properly supports the subject matter relied upon to make the rejection in compliance with 35 U.S.C. 112, first paragraph. See MPEP § 2136.03 (III).

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The Provisional Patent Application Serial No. 60/177,075 of Dillon properly supports the subject matter relied upon to make the rejection (See page 13, lines 20-27).

Thus, the earliest priority date of Dillon is January 19, 2000, which is prior the effective filing date of the present Application.

***Conclusion***

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elena Tsoy whose telephone number is (571) 272-1429. The examiner can normally be reached on Mo-Thur. 9:00-7:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-141523. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Elena Tsoy  
Primary Examiner  
Art Unit 1762

ELENA TSOY  
PRIMARY EXAMINER

*E Tsoy*

June 23, 2005